

1. INTRODUCTION

Starting at about GMT 2021-06-10, 161/13:00:00, one of the International Space Station (ISS) crew began about a 30-minute exercise period using the BD-2 treadmill equipment located in Zvezda Service Module. This exercise period was relatively rare in that it was the only exercise happening during that period of time aboard the space station.

2. QUALIFY

The information shown in the spectrogram of Figure 1 was calculated from SAMS sensor 121f03 measurements made in the US Laboratory. This plot focuses on the lower-frequency, structural mode and crew activity regime of the vibratory environment, including Urine Processing Assembly (UPA) operations near 3.7 Hz. It shows increased structural vibration excitation contained between about GMT 13:00 and 13:30 as imparted by the crew exercising on the BD-2 treadmill in the Zvezda Service Module. Note the heightened vibrations (red, horizontal streaks) during the exercise period between around 1.3 Hz and some additional harmonic content at about 3.7 Hz, just after and just above the narrowband UPA signature.

3. QUANTIFY

In order to quantify the impact of this BD-2 exercise, we again focus our attention below 5 Hz and show root-mean-square (RMS) values for five SAMS sensor heads distributed throughout the ISS. For example, Figure 2 shows X-, Y-, and Z-axis values in red computed during the exercise period and we contrast that to the black trace for data outside of the exercise period **and** between GMT 11:00 and 15:00. Four more plots of RMS acceleration values versus time for SAMS sensors distributed throughout the ISS are shown, and similarly marked in red, starting with Figure 3 on page 2.

4. CONCLUSION

The RMS values for the two SAMS sensors in Columbus show the largest impact due to BD-2 exercise, followed by a sensor in the JEM and finally, the two SAMS sensors in the US LAB. This is reinforced by the median values tabulated in the Table 1 on page 4. Those interested in the impact of BD-2 exercise can also take a look at another, less-impactful data set at [this link](#).

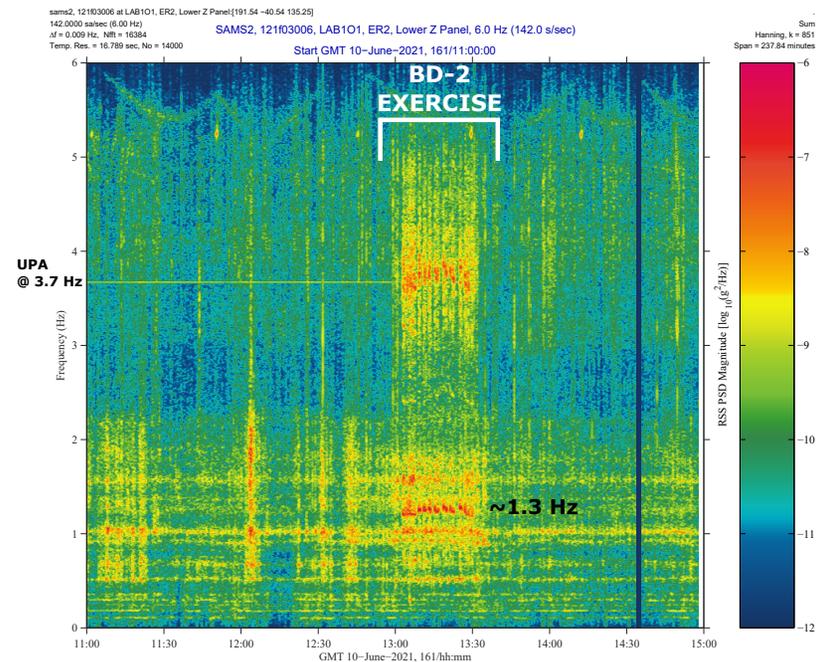


Fig. 1: Spectrogram showing Crew BD-2 Exercise on GMT 2021-06-10.

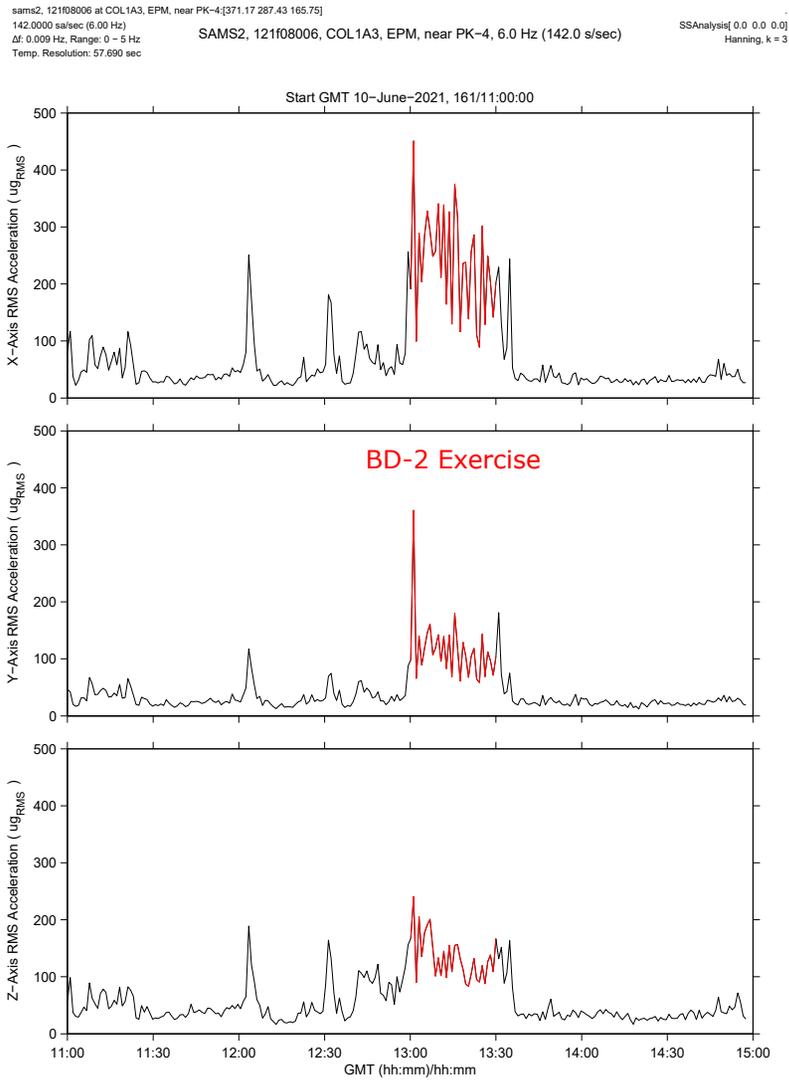


Fig. 2: RMS Below 5 Hz for SAMS 121f08 sensor in COL.

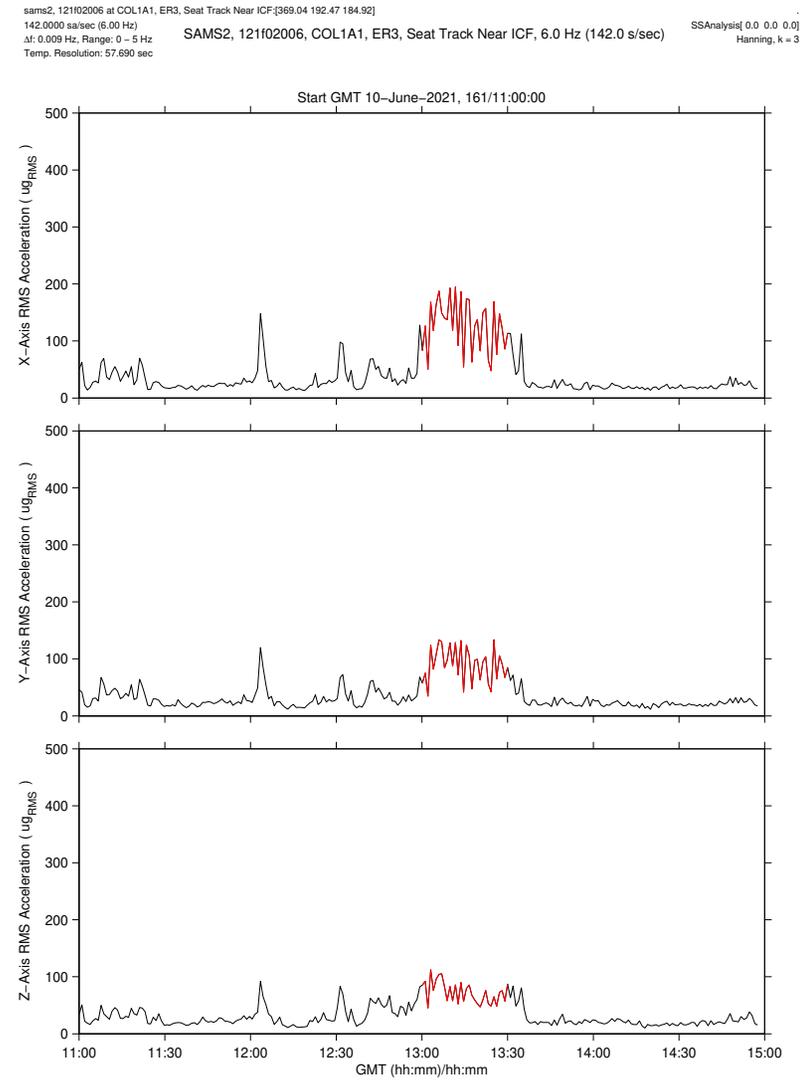
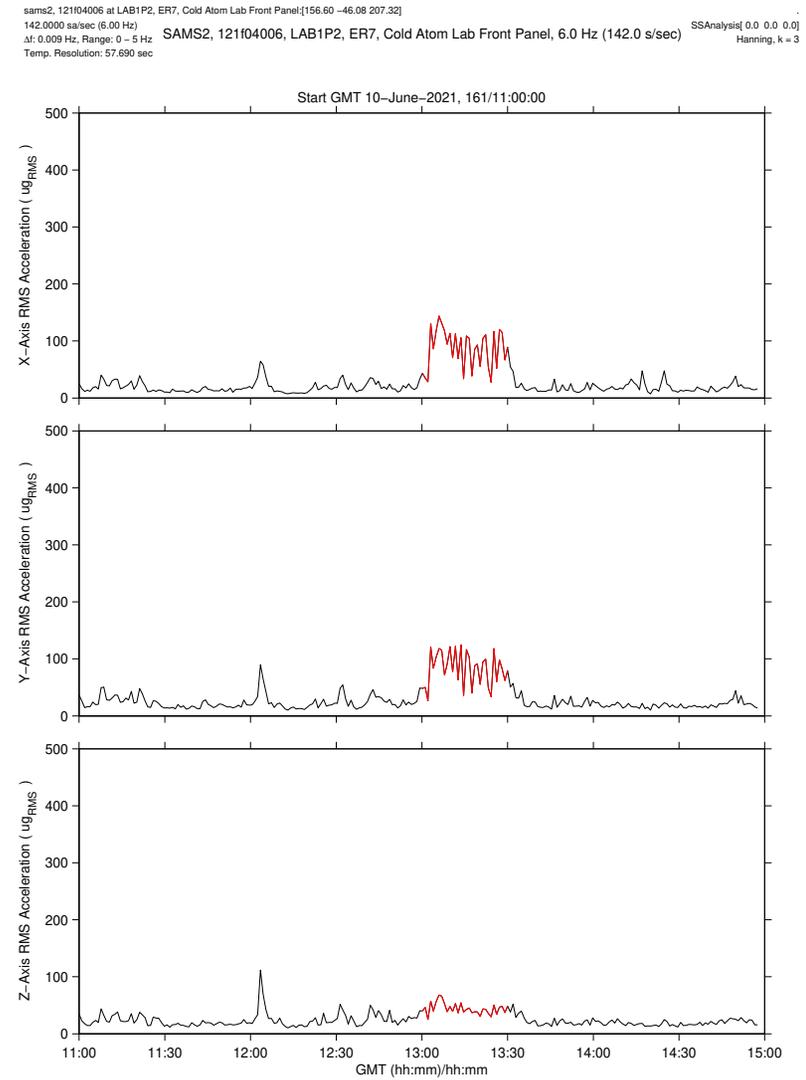
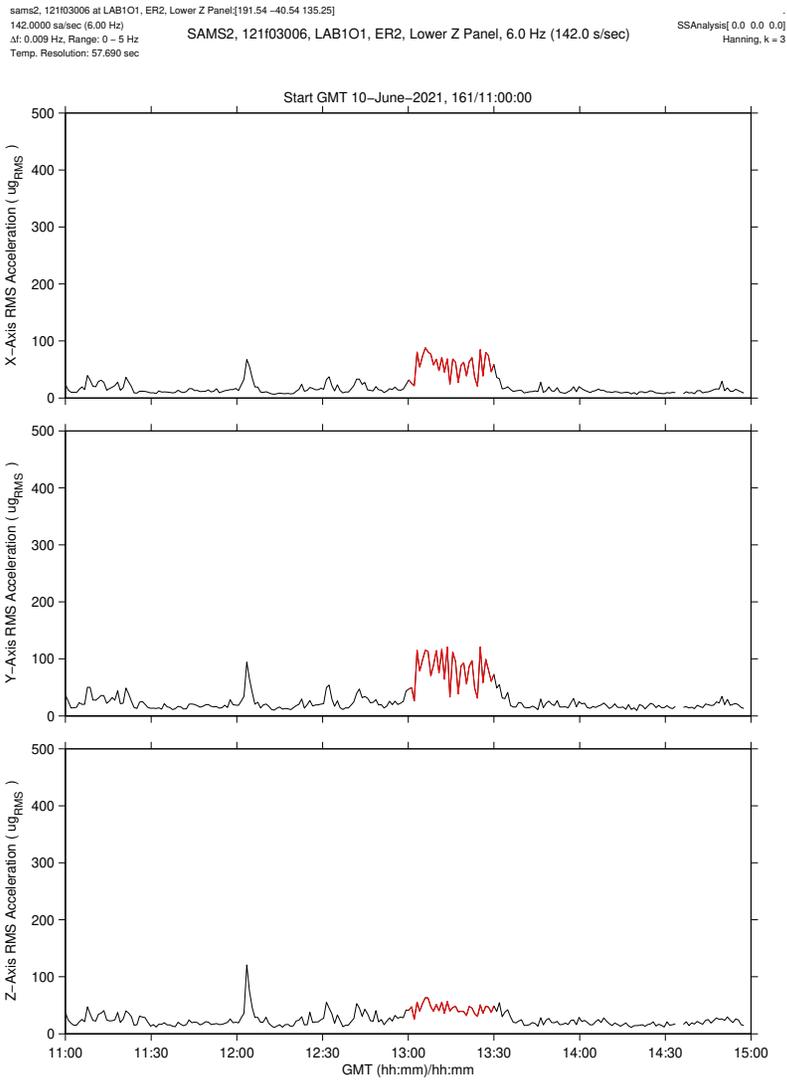


Fig. 3: RMS Below 5 Hz for SAMS 121f02 sensor in COL.



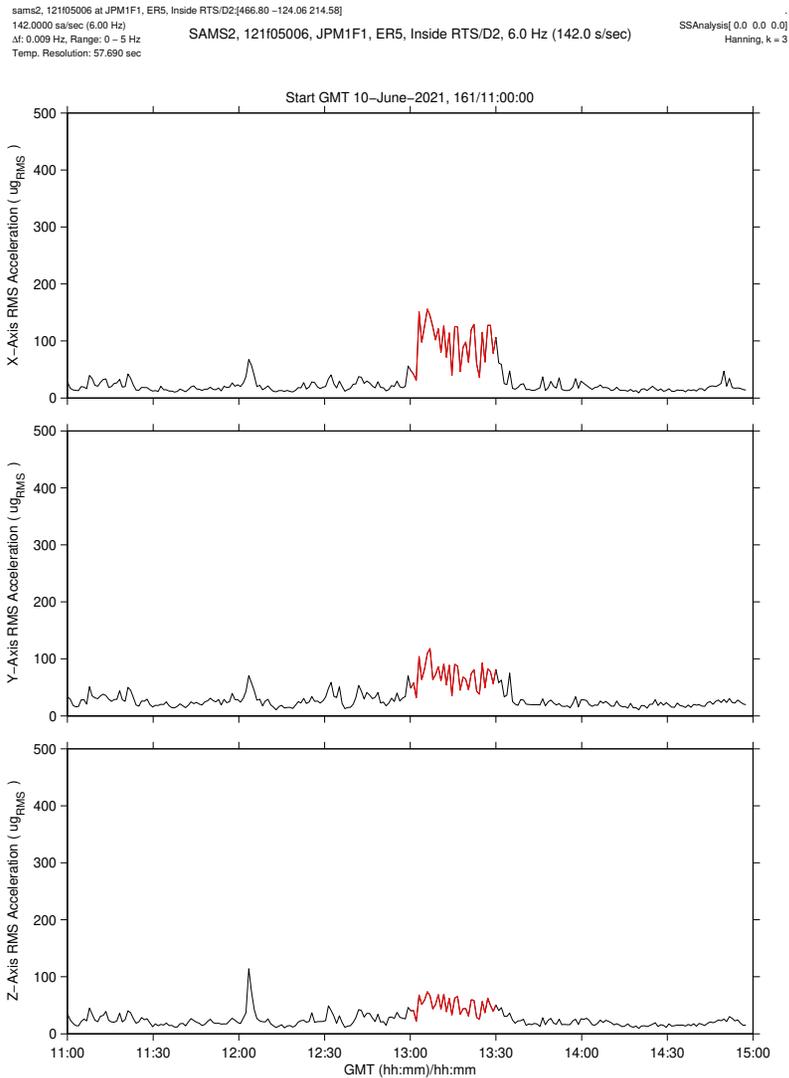


Fig. 6: RMS Below 5 Hz for SAMS 121f05 sensor in JEM.

Table 1. RMS Below 5 Hz, Comparison Exercise vs. Non-Exercise Periods.

DURING EXERCISE PERIOD				
Location	Sensor	Per-Axis RMS (micro-g)		
		X	Y	Z
COL1A3	121f08	243.3	106.1	131.9
COL1A1	121f02	131.9	93.1	74.2
JPM1F1	121f05	104.1	70.0	50.2
LAB1P2	121f04	93.7	85.7	42.9
LAB1O1	121f03	60.6	83.7	45.7

NON-EXERCISE PERIOD				
Location	Sensor	Per-Axis RMS (micro-g)		
		X	Y	Z
COL1A3	121f08	36.7	25.3	37.6
COL1A1	121f02	22.4	24.0	22.4
JPM1F1	121f05	17.9	23.4	20.4
LAB1P2	121f04	15.9	19.6	19.5
LAB1O1	121f03	12.5	18.9	20.5